Titles of Most Frequently Occurring Classifications of Patents Returned
From A Search of 10202884 on August 15, 2003

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3   73/863.12     (0 OR, 3 XR)
        Class    073 :  MEASURING AND TESTING
        73/863          SAMPLER, SAMPLE HANDLING, ETC.
        73/863.11       .With heating or cooling
        73/863.12       ..And separation

3  250/288        (2 OR, 1 XR)
        Class    250 :  RADIANT ENERGY
        250/281         IONIC SEPARATION OR ANALYSIS
        250/288         .With sample supply means

3  435/286.1      (0 OR, 3 XR)
        Class    435 :  CHEMISTRY: MOLECULAR BIOLOGY AND MICROBIOLOGY

        435/283.1       APPARATUS
        435/286.1       .Including condition or time responsive control
                           means

3  704/219        (1 OR, 2 XR)
        Class    704 :  DATA PROCESSING: SPEECH SIGNAL PROCESSING,
                         LINGUISTICS, LANGUAGE TRANSLATION, AND AUDIO
                         COMPRESSION/DECOMPRESSION
        704/200         SPEECH SIGNAL PROCESSING
        704/201         .For storage or transmission
        704/219         ..Linear prediction

3  704/223        (2 OR, 1 XR)
        Class    704 :  DATA PROCESSING: SPEECH SIGNAL PROCESSING,
                         LINGUISTICS, LANGUAGE TRANSLATION, AND AUDIO
                         COMPRESSION/DECOMPRESSION
        704/200         SPEECH SIGNAL PROCESSING
        704/201         .For storage or transmission
        704/221         ..Pattern matching vocoders
        704/223         ...Excitation patterns

2   73/863.11     (0 OR, 2 XR)
        Class    073 :  MEASURING AND TESTING
        73/863          SAMPLER, SAMPLE HANDLING, ETC.
        73/863.11       .With heating or cooling

2   73/864.81     (0 OR, 2 XR)
        Class    073 :  MEASURING AND TESTING
        73/863          SAMPLER, SAMPLE HANDLING, ETC.
        73/864.81       .Analyzer supplier

2  250/283        (0 OR, 2 XR)
        Class    250 :  RADIANT ENERGY
        250/281         IONIC SEPARATION OR ANALYSIS
        250/282         .Methods
        250/283         ..With collection of ions

2  374/11         (1 OR, 1 XR)
        Class    374 :  THERMAL MEASURING AND TESTING
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374/10 DIFFERENTIAL THERMAL ANALYSIS
374/11 .Detail of electrical heating control

2 422/80 (0 OR, 2 XR)
Class 422 : CHEMICAL APPARATUS AND PROCESS DISINFECTING, DEODORIZING, PRESERVING, OR STERILIZING
422/50 ANALYZER, STRUCTURED INDICATOR, OR MANIPULATIVE LABORATORY DEVICE
422/68.1 .Means for analyzing liquid or solid sample
422/78 ..Including means for pyrolysis, combustion, or oxidation
422/80 ...And means directly analyzing evolved gas

2 422/83 (2 OR, 0 XR)
Class 422 : CHEMICAL APPARATUS AND PROCESS DISINFECTING, DEODORIZING, PRESERVING, OR STERILIZING
422/50 ANALYZER, STRUCTURED INDICATOR, OR MANIPULATIVE LABORATORY DEVICE
422/83 .Means for analyzing gas sample

2 432/19 (0 OR, 2 XR)
Class 432 : HEATING
432/1 PROCESSES OF HEATING OR HEATER OPERATION
432/19 .Controlling flame position or work atmosphere

2 435/252.3 (0 OR, 2 XR)
Class 435 : CHEMISTRY: MOLECULAR BIOLOGY AND MICROBIOLOGY

435/243 MICRO-ORGANISM, PER SE (E.G., PROTOZOA, ETC.); COMPOSITIONS THEREOF; PROCES OF PROPAGATING,
MAINTAINING OR
PRESERVING MICRO-ORGANISMS OR COMPOSITIONS THEREOF;
PROCESS
OF PREPARING OR ISOLATING A COMPOSITION CONTAINING
A
MICRO-ORGANISM; CULTURE MEDIA THEREFOR
435/252.1 .Bacteria or actinomycetales; media therefor
435/252.3 ..Transformants (e.g., recombinant DNA or vector or foreign or exogenous gene containing, fused bacteria, etc.)

2 435/320.1 (0 OR, 2 XR)
Class 435 : CHEMISTRY: MOLECULAR BIOLOGY AND MICROBIOLOGY

435/320.1 VECTOR, PER SE (E.G., PLASMID, HYBRID PLASMID, COSMID, VIRAL VECTOR, BACTERIOPHAGE VECTOR, ETC.) BACTERIOPHAGE VECTOR, ETC.)

2 435/325 (0 OR, 2 XR)
Class 435 : CHEMISTRY: MOLECULAR BIOLOGY AND MICROBIOLOGY

435/325 ANIMAL CELL, PER SE (E.G., CELL LINES, ETC.); COMPOSITION THEREOF; PROCESS OF PROPAGATING,
MAINTAINING OR
PRESERVING AN ANIMAL CELL OR COMPOSITION THEREOF;
PROCESS

OF ISOLATING OR SEPARATING AN ANIMAL CELL OR
COMPOSITION
THEREOF; PROCESS OF PREPARING A COMPOSITION
CONTAINING AN
ANIMAL CELL; CULTURE MEDIA THEREFORE

2 435/471 (0 OR, 2 XR)
Class 435 : CHEMISTRY: MOLECULAR BIOLOGY AND MICROBIOLOGY

435/455 .Introduction of a polynucleotide molecule into
or rearrangement of nucleic acid within an animal
cell
435/471 .Introduction of a polynucleotide molecule into
or rearrangement of nucleic acid within a
microorganism
(e.g., bacteria, protozoa, bacteriophage, etc.)

2 435/6 (1 OR, 1 XR)
Class 435 : CHEMISTRY: MOLECULAR BIOLOGY AND MICROBIOLOGY

435/4 MEASURING OR TESTING PROCESS INVOLVING ENZYMES
OR MICRO-ORGANISMS; COMPOSITION OR TEST STRIP
THEREFORE;
PROCESSES OF FORMING SUCH COMPOSITION OR TEST STRIP
435/6 .Involving nucleic acid

2 436/34 (0 OR, 2 XR)
Class 436 : CHEMISTRY: ANALYTICAL AND IMMUNOLOGICAL
TESTING
436/34 RATE OF REACTION DETERMINATION

2 436/55 (1 OR, 1 XR)
Class 436 : CHEMISTRY: ANALYTICAL AND IMMUNOLOGICAL
TESTING
436/55 CONDITION RESPONSIVE CONTROL

2 704/264 (1 OR, 1 XR)
Class 704 : DATA PROCESSING: SPEECH SIGNAL PROCESSING,
LINGUISTICS, LANGUAGE TRANSLATION, AND AUDIO
COMPRESSION/DECOMPRESSION
704/200 SPEECH SIGNAL PROCESSING
704/258 .Synthesis
704/264 ..Excitation

2 800/266 (0 OR, 2 XR)
Class 800 : MULTICELLULAR LIVING ORGANISMS AND UNMODIFIED
PARTS THEREOF AND RELATED PROCESSES
800/260 METHOD OF USING A PLANT OR PLANT PART IN A
BREEDING PROCESS WHICH INCLUDES A STEP OF SEXUAL
HYBRIDIZATION
800/266 .Method of breeding involving a genotypic or
phenotypic marker

2 800/268 (0 OR, 2 XR)
Class 800 : MULTICELLULAR LIVING ORGANISMS AND UNMODIFIED
PARTS THEREOF AND RELATED PROCESSES
800/260 METHOD OF USING A PLANT OR PLANT PART IN A

BREEDING PROCESS WHICH INCLUDES A STEP OF SEXUAL HYBRIDIZATION
800/268 .Method of breeding involving a tissue culture step

2 800/271 (0 OR, 2 XR)
Class 800 : MULTICELLULAR LIVING ORGANISMS AND UNMODIFIED PARTS THEREOF AND RELATED PROCESSES
800/260 METHOD OF USING A PLANT OR PLANT PART IN A BREEDING PROCESS WHICH INCLUDES A STEP OF SEXUAL HYBRIDIZATION
800/271 .Method of breeding using gametophyte control

2 800/298 (0 OR, 2 XR)
Class 800 : MULTICELLULAR LIVING ORGANISMS AND UNMODIFIED PARTS THEREOF AND RELATED PROCESSES
800/295 PLANT, SEEDLING, PLANT SEED, OR PLANT PART, PER SE
800/298 .Higher plant, seedling, plant seed, or plant part (i.e., angiosperms or gymnosperms)

2 800/301 (0 OR, 2 XR)
Class 800 : MULTICELLULAR LIVING ORGANISMS AND UNMODIFIED PARTS THEREOF AND RELATED PROCESSES
800/295 PLANT, SEEDLING, PLANT SEED, OR PLANT PART, PER SE
800/298 .Higher plant, seedling, plant seed, or plant part (i.e., angiosperms or gymnosperms)
800/301 ..Pathogen resistant plant which is transgenic or mutant

2 800/302 (0 OR, 2 XR)
Class 800 : MULTICELLULAR LIVING ORGANISMS AND UNMODIFIED PARTS THEREOF AND RELATED PROCESSES
800/295 PLANT, SEEDLING, PLANT SEED, OR PLANT PART, PER SE
800/298 .Higher plant, seedling, plant seed, or plant part (i.e., angiosperms or gymnosperms)
800/302 ..Insect resistant plant which is transgenic or mutant

2 800/303 (0 OR, 2 XR)
Class 800 : MULTICELLULAR LIVING ORGANISMS AND UNMODIFIED PARTS THEREOF AND RELATED PROCESSES
800/295 PLANT, SEEDLING, PLANT SEED, OR PLANT PART, PER SE
800/298 .Higher plant, seedling, plant seed, or plant part (i.e., angiosperms or gymnosperms)
800/303 ..Male-sterile

2 800/320.1 (2 OR, 0 XR)
Class 800 : MULTICELLULAR LIVING ORGANISMS AND UNMODIFIED PARTS THEREOF AND RELATED PROCESSES
800/295 PLANT, SEEDLING, PLANT SEED, OR PLANT PART, PER SE
800/298 .Higher plant, seedling, plant seed, or plant

part (i.e., angiosperms or gymnosperms)

800/320 ..Gramineae (e.g., barley, oats, rye, sorghum, millet, etc.)

800/320.1 ...Maize

US-PAT-NO: **6275750**

DOCUMENT-IDENTIFIER: US 6275750 B1

TITLE: Apparatus for setting heating condition in heating furnace and thermal analyzer for object to be heated in heating furnace

---------- KWIC ---------

Abstract Text - ABTX (1):

The present invention relates to a method and apparatus for setting heating conditions in a heating furnace wherein a temperature distribution of an object to be heated is measured required minimum times and **thermal analysis** for the object is performed, thereby optimally heating the object. When the object to be heated is heated by means of a plurality of heating sources in the heating furnace, heating conditions are set to the heating sources respectively, the object is heated, a temperature of the heated object is then detected at a plurality of detection points, a relationship between a variation in the heating conditions in one of the heating sources and a variation in a detected temperature at each of the detection points of the heated object is computed for each heating source, heating conditions in the heating source for causing the detection point of the heated object to have a target temperature are calculated based on the computed relationship, and the heating sources are controlled on the calculated heating conditions.

US Patent No. - PN (1):

6275750

Brief Summary Text - BSTX (16):

Therefore, the following has been investigated. **Thermal analysis** is performed by using a computer to quantitatively grasp a heating state in the reflow furnace in order to enhance reliability of the printed-wiring

board.
Moreover, the temperature profile of a heated object in the reflow furnace is
predicted and utilized for setting the optimum operation conditions in the
reflow furnace.

Brief Summary Text - BSTX (17):
FIG. 10 is a flowchart showing a processing of performing **thermal analysis**
for the printed-wiring board in the reflow furnace using the prior art.

Brief Summary Text - BSTX (18):
At Steps 501 to 507, an analytic model of the printed-wiring board is first
generated in order to perform the **thermal analysis** for the printed-wiring
board. On the printed-wiring board are mounted electronic components having
several hundred or more junction terminals such as lead frames having fine and
complicated shapes which are referred to as a QFP (Quad Flat Package), a SOP
(Small Outline Package), a BGA (Ball Grid Array) and the like.

Brief Summary Text - BSTX (26):
Accordingly, it is necessary to accurately calculate a radiation heat
quantity received by the printed-wiring board from the infrared heater at Step
508 in order to perform the **thermal analysis** for the printed-wiring board in
the reflow furnace. The Step 508 will be described below.

Brief Summary Text - BSTX (29):
The printed-wiring board receives a heat quantity by convection **heat transfer** in an atmosphere in the furnace and is thus heated. Therefore, the
heat quantity is also calculated at Step 509. The sum of these heat quantities
is set as a boundary condition to an analytic model of the printed-wiring board
at Step 510.

Brief Summary Text - BSTX (30):
Next, the printed-wiring board having the boundary condition set is analyzed
at Step 511. This analysis is executed by a finite element method, a
difference method and the like. As described above, the printed-wiring board
is carried by means of the conveyer in the heating furnace, and a

relative
position relationship between each heater and the printed-wiring board is
changed with time. For this reason, the radiation heat quantity received by
the printed-wiring board, that is, the radiation boundary condition is not
constant but is changed with time. Therefore, it is necessary to recalculate
the radiation boundary condition every certain time. Also in a heating state
obtained by the convection, an atmospheric temperature and a convection **heat**
transfer coefficient are varied depending on a position in the furnace.

Therefore, it is also necessary to recalculate the convection boundary condition every certain time. For this reason, it is decided whether or not
the analysis has been performed up to an outlet of the furnace at Step 512. If
the outlet of the furnace is not reached, the Steps 508 to 511 are repeated.

Brief Summary Text - BSTX (31):
With conventional **thermal analysis** software, such a boundary condition which
is changed with time has been neither calculated nor automatically set to a
thermal analysis object. Therefore, it has been necessary to manually perform
all these works.

Brief Summary Text - BSTX (33):
Conventionally, the analytic model of the printed-wiring board created by
using much man-day has been set by repetitive calculation of the radiation
boundary condition and the convection boundary condition in each position in
the furnace as described above, thereby performing **thermal analysis** while the
printed-wiring board enters the reflow furnace and gets out thereof.

Brief Summary Text - BSTX (34):
Thus, the conventional thermal analyzing technique has the following
problems. Therefore, the **thermal analysis** for the printed-wiring board in the
reflow furnace could not easily be performed.

Brief Summary Text - BSTX (35):
1+L The **thermal analysis** object (printed-wiring board) is carried by means

of the conveyer in the heating furnace, and radiation and convection boundary conditions are changed with time. Therefore, it is necessary to calculate and set the radiation boundary condition and the convection boundary condition for the **thermal analysis** object every constant time.

Brief Summary Text - BSTX (37):

In order to solve these respects, accordingly, it is important to develop the method for simplifying the analytic model having high analysis precision which can be applied to non-steady heat conduction **analysis (for example, thermal analysis** for the printed-wiring board moving in the reflow furnace) for a long time.

Brief Summary Text - BSTX (42):

In order to solve such a problem of the computation time, conventionally, the printed-wiring board has generally been treated as a two-dimensional analytic model to shorten the computation time. In this case, however, electronic components mounted on the substrate are simply modeled. Therefore, **heat transfer** between the substrate and the electronic component cannot accurately be considered for the analysis so that errors are increased around the components.

Brief Summary Text - BSTX (44):

The present invention has been made in consideration of such circumstances, and provides an apparatus for setting heating conditions in a heating furnace which can measure a temperature distribution of an object to be heated required minimum times or can perform **thermal analysis** for the object without repeatedly setting the heating conditions many times by a worker's perception or guess, thereby optimally heating the object.

Brief Summary Text - BSTX (45):

Furthermore, the present invention provides a thermal analyzer capable of easily performing **thermal analysis** for a heated object in a heating furnace without requiring much man-day and specially technical knowledge for the

thermal analysis and of obtaining almost the same temperature distribution
result as in a case where the object is actually put in the heating furnace.

Brief Summary Text - BSTX (46):
In addition, the present invention provides a thermal analytic model of a
printed-wiring board which can considerably reduce the number of computation
elements and can perform **thermal analysis** in a shorter time than in a case
where a conventional analytic model is used.

Brief Summary Text - BSTX (61):
FIG. 10 is a flowchart showing a processing of performing **thermal analysis**
for the printed-wiring board in the reflow furnace by using the prior art;

Brief Summary Text - BSTX (69):
FIG. 18 is a view illustrating a computation grid to perform **thermal analysis** for a printed-wiring board according to the prior art.

Detailed Description Text - DETX (6):
It is necessary to detect a temperature of the heated object at a plurality
of detection points. It is preferable that the number of the detection points
should be coincident with that of the heating sources to solve plural
simultaneous equations. The temperature of the object may be detected at the
detection point by attaching a temperature sensor such as a thermoelectric
couple to the object or by performing **thermal analysis** based on computation.
In a case where the computation is to be performed, a thermal analyzing method
described in Japanese Laid-Open Patent Publication No. Hei 8-152377 filed on
Jun. 13, 1996 by the present applicant can be applied, for example.

Detailed Description Text - DETX (19):
Various display devices such as a CRT display device, a plasma display
device and the like and various printers such as a **heat transfer** printer, a
laser printer and the like can be used as the output means.

Detailed Description Text - DETX (22):

Consequently, a user can easily perform the **thermal analysis** for the object such as the printed-wiring board in the heating furnace by using the thermal analyzer for the object in the heating furnace according to the present invention, for example.

Detailed Description Text - DETX (25):

The present invention further provides a controller for a reflow furnace comprising a thermal analyzer which performs **thermal analysis** for a printed-wiring board moving in the reflow furnace, and a heating condition setting apparatus for setting heating conditions in the reflow furnace based on a result of the **thermal analysis** obtained by the thermal analyzer, the thermal analyzer including shape and physical property value input means for inputting a shape of a printed-wiring board to be heated in the reflow furnace and a physical property value thereof, a shape of a component mounted on the printed-wiring board and a physical property value thereof, a shape of a gap space between the component and the printed-wiring board, and a shape of a terminal space having a terminal for connecting the component and the printed-wiring board and a physical property value of the terminal, component and gap space model setting means for setting a model in which the input component and gap space is regarded as a rectangular prism having a thickness that is almost equal to a thickness of the printed-wiring board, terminal model setting means for setting a model in which the input terminal space is regarded as a rectangular prism having a thickness corresponding to a size of the terminal, correcting means for correcting physical property values for the rectangular prism models of the component, the gap space and the terminal space which are thus obtained, computation grid generating means for dividing the rectangular prism model in a grid shape to generate a computation grid and for defining a physical property value for each computation element divided by the computation grid, heating condition input means for inputting heating conditions in the heating furnace, setting means for setting, on the input heating conditions, a radiation boundary condition and a convection boundary condition of the object which are changed with a passage of time,

calculating
means for calculating a temperature distribution for each computation element
every movement of the object within a predetermined range based on the radiation boundary condition and the convection boundary condition which are
set by the setting means and heat conduction in the object for each computation
element generated by the computation grid generating means, and output means
for outputting the temperature distribution calculated by the calculating
means, and the heating condition setting apparatus including heating condition
setting means for setting heating conditions to a plurality of heating sources
respectively when heating the object by means of the heating sources in the
heating furnace, temperature detecting means for receiving, from the thermal
analyzer, a temperature distribution for each computation element of the heated
rectangular prism model, computing means for computing, for each heating
source, a relationship between a variation in the heating conditions in one of
the heating sources and a variation in a temperature of each computation
element of the rectangular prism model, heating condition calculating means for
calculating heating conditions in the heating source for causing the computation element of the rectangular prism model to have a target temperature
based on the computed relationship, and control means for controlling the
heating sources on the calculated heating conditions.

Detailed Description Text - DETX (41):
The temperatures at the temperature detection points 1 to 4 are not actually
measured but may be obtained by performing **thermal analysis** based on computation. In a case where the temperatures are to be obtained by the
calculation, it is possible to apply the thermal analyzing method described in
the Japanese Laid-Open Patent Publication No. Hei 8-152377 filed on Jun. 13,
1996 by the present applicant and a method using a thermal analyzer according
to a second embodiment which will be described below.

Detailed Description Text - DETX (50):
At Step S4, a temperature t.sub.j0 at each temperature detection point j on

the basic reflow condition 0 is acquired for the temperature detection points 1 to J on the printed-wiring board 2. In the present embodiment, **thermal analysis** for the printed-wiring board 2 is performed to obtain the temperature t.sub.j0 from a result of the **thermal analysis**.

Detailed Description Text - DETX (52):

At Step S6, a temperature distribution of the printed-wiring board 2 is acquired on the reflow condition i which has been changed at the Step S5. In other words, a temperature t.sub.ji at each temperature detection point j is acquired. In the same manner as in the Step S4, the **thermal analysis** is performed to obtain a temperature t.,sub.ji at the temperature detection point j on the reflow condition i.

Detailed Description Text - DETX (53):

At Step S7 are calculated a variation .DELTA.t.sub.ji between the temperature t.sub.jo. on the reflow condition 0 and the temperature t.sub.ji on the reflow condition i at the temperature detection point j and a variation .DELTA.T.sub.ii between the set value T.sub.i0 on the reflow condition 0 and the set value T.sub.ii on the reflow condition i in the heating source i. By the following equation, a **coefficient** a.sub.ij related to the variation .DELTA.T.sub.ii in the set value of the heating source i and the variation .DELTA.t.sub.ji in the temperature at the temperature detection point j is calculated.

Detailed Description Text - DETX (55):

At the Step S10, the following simultaneous equations related to a difference .DELTA.tt.sub.j between the target temperature tt.sub.j at the temperature detection point j and the temperature t.sub.j0 on the reflow condition 0 are set up based on a variation .DELTA.tT.sub.i between a set value tT.sub.i of each of the heating sources 1 to I for causing the temperature detection point j to have a target temperature and the set value T.sub.i0 on the reflow condition 0, and the **coefficient** a.sub.ij obtained at the Step S7.

Detailed Description Text - DETX (65):
FIG. 6 is a block diagram showing a structure of the thermal analyzer for the object in the heating furnace according to the present invention. Since the thermal analyzer for the object in the heating furnace according to the present invention uses a CPU, it will be hereinafter referred to as a thermal analyzing system. There will be described, as an example, **thermal analysis** in which a reflow furnace is applied as the heating furnace and a printed-wiring board (which is also referred to as a printed board or a substrate) having electronic components mounted thereon is applied as the object. More specifically, description will be given on the assumption that the thermal analyzing system widely performs the **thermal analysis** for the printed-wiring board during reflow heating. Hardware of the thermal analyzer can serve as a computer and an I/O device which have been used in the apparatus for setting heating conditions according to the first embodiment.

Detailed Description Text - DETX (74):
The reflow condition setting section 104 causes the furnace radiation characteristic data storing section 109 to store information necessary for radiation **heat transfer** computation such as an area of the heater, a temperature thereof, a position relationship with the printed-wiring board and the like, causes the furnace convection characteristic data storing section 110 to store information necessary for convection **heat transfer** computation such as a convection **heat transfer coefficient** and an atmospheric temperature and the like, and updates the contents of the input information.

Detailed Description Text - DETX (77):
wherein F represents a Radiation shape factor indicative of an extent of influence of the radiation, .sigma. represents a Stefan-Boltzmann **coefficient,** A represents an area of one mesh of the printed-wiring board which is cut into a grid shape, T.sub.H represents a temperature of a heater [K (absolute temperature)], and T.sub.P represents a temperature of the printed-wiring board [K (absolute temperature)].

Detailed Description Text - DETX (79):
wherein h represents a convection **coefficient** which is related to a wind speed of the blower, A represents an area of one mesh of the printed-wiring board cut into a grid shape, T.sub.A represents an atmospheric temperature [.degree. C. (centigrade)] and T.sub.P represents a temperature of the printed-wiring board [.degree. C. (centigrade)].

Detailed Description Text - DETX (81):
The analyzing section 119 reads the computation grid stored in the computation grid data storing section 115, and performs a **thermal analysis** processing based on the radiation boundary condition output from the radiation boundary condition setting section 113 and the convection boundary condition output from the convection boundary condition setting section 114.

Detailed Description Text - DETX (92):
Finally, the temperature distribution data of the printed-wiring board which has been subjected to the graphic processing is displayed on the display device 102 at Step 410. Consequently, a worker for performing the analysis can obtain the result of the **thermal analysis** for the printed-wiring board.

Detailed Description Text - DETX (94):
The radiation boundary conditions and the convection boundary conditions which are changed with a passage of time in the heating furnace are automatically set every constant time. Based on these boundary conditions, therefore, the **thermal analysis** is automatically performed every constant time for the analytic model of the printed-wiring board which has the computation grid created. Thus, a temperature profile for each computation grid of the printed-wiring board can be calculated.

Detailed Description Text - DETX (95):
Accordingly, a user can easily perform the **thermal analysis** for the printed-wiring board in the reflow furnace by using the thermal analyzing system. Consequently, the following excellent effects can be obtained.

Detailed Description Text - DETX (97):

(2) During the **thermal analysis,** it is not necessary to reset, every constant elapsed time, the radiation boundary conditions and the convection boundary conditions which are changed by the movement of the printed-wiring board in the furnace.

Detailed Description Text - DETX (99):

As a third embodiment, a method for modeling **thermal analysis** of an object (a printed-wiring board) to be heated in a reflow furnace will be described below. An analytic model according to the present embodiment acts as an analytic model of the printed-wiring board including two or more layered computation elements having the same thickness as in a substrate on one face or both faces of the substrate.

Detailed Description Text - DETX (139):

In the method for modeling the **thermal analysis** for the printed-wiring board according to the present invention described above, the space between the computation grids was increased so that the number of the computation elements can greatly be reduced and analysis computation can be performed in a shorter time than in a case where a conventional analytic model is used. Furthermore, the analytic model has very few errors caused by the modeling because the corrected physical property values are defined for use depending on an actual shape of a component (a height of a component and a thickness of a component body) and a material.

Detailed Description Text - DETX (143):

According to the thermal analyzer for an object to be heated in the heating furnace in accordance with the present invention, a shape of the object and a physical property value thereof are input, and heating conditions in the heating furnace are input. Consequently, a temperature distribution for each computation grid can automatically be calculated for each movement of the object within a predetermined range based on radiation boundary conditions and convection boundary conditions of the object which are changed with a

passage
of time, and heat conduction in the object. Thus, **thermal analysis** can easily
be performed for the object such as the printed-wiring board in the heating
furnace.

Claims Text - CLTX (31):

6. A computer readable recording medium which records a **thermal analysis**
program of an object to be heated in a heating furnace, causing a computer to
execute the steps of:

Claims Text - CLTX (38):

7. The computer readable recording medium which records a **thermal analysis**
program of an object to be heated in a heating furnace according to claim 6,
wherein the step of inputting a shape of the object and a physical property
value thereof includes a step of inputting a shape of a printed-wiring board
and a physical property value thereof, a shape of a component mounted on the
printed-wiring board and a physical property value thereof, a shape of a gap
space between the component and the printed-wiring board, and a shape of a
terminal space having a terminal for connecting the component and the
printed-wiring board and a physical property value of the terminal, and

Claims Text - CLTX (40):

8. A controller for a reflow furnace comprising a thermal analyzer which
performs **thermal analysis** for a printed-wiring board moving in the reflow
furnace, and a heating condition setting apparatus for setting heating
conditions in the reflow furnace based on a result of the **thermal analysis**
obtained by the thermal analyzer,

Claims Text - CLTX (58):

performing **thermal analysis** for a printed-wiring board moving in the reflow
furnace; and

Claims Text - CLTX (59):

setting heating conditions of the reflow furnace based on a result of the
thermal analysis obtained at the thermal analyzing step,